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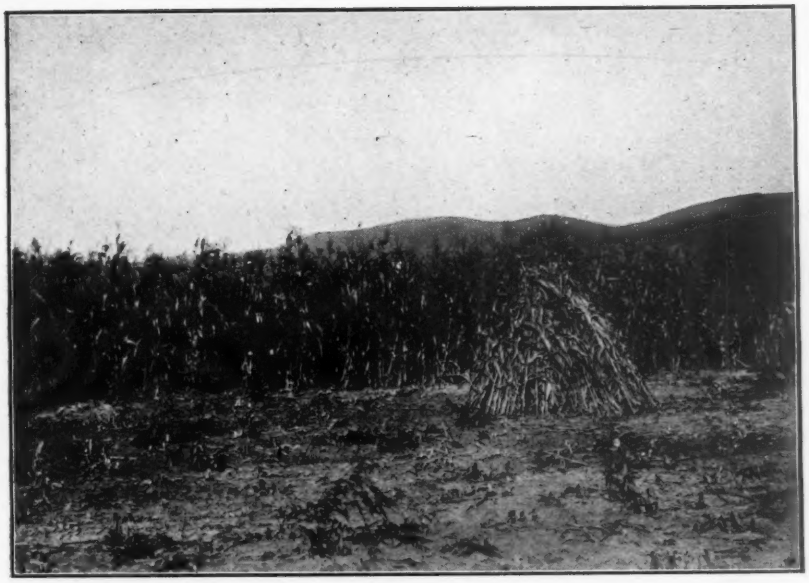

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GEORGE C. CALDWELL.

The Cornell Countryman

Vol. 11 OCTOBER, 1913 No. 1

GEORGE C. CALDWELL

When ex-President Andrew D. White was first appointed he traveled extensively in search of professors. At Antioch College, Ohio, he found a man who was destined to play a very important part in the development of the new university, and whose name like those of White, Goldwin Smith, Agassiz, cannot be separate from an account of its early history. Caldwell Field is named for George C. Caldwell, the first professor appointed at Cornell University. It is fitting that a field which is contributing so much to scientific agriculture should be named for such a scientist.

Professor Caldwell's contributions were chiefly in the field of agricultural chemistry and he was a pioneer in this field. Liebig, had written quite extensively on agricultural chemistry in Germany, but Agricultural Chemical Analysis, written by Professor Caldwell was the first book on this subject in the English language. He published books in other branches of chemistry which were widely accepted as texts and helped to build up the reputation of 'he University. He was a member of the Federal Sanitary Commission in the Civil War, one of the founders of the Society for the Promotion of Agricultural Science, a member of the American Association for the Advancement of Science. At one time he was president of the American Chemical Society.

Although Professor Caldwell was pre-eminently a scholar, he was remarkably successful as an Administrator. Under his guidance the Department of Chemistry developed from a poorly equipped department with very cramped quarters in the basement of Morrill Hall until during the last part of his administration Morse Hall was built with a floor space of 65,000 square feet and enrolling on the average 1400 students per term. From 1872 to 1886 he was the Secretary of the University Faculty. He rendered services to Cornell at the time when a stout heart was just as essential as a keen mind.

Professor Caldwell was also a teacher. Many of his pupils are now distinguished scientists. One can scarcely realize the powerful influence which he exerted, an influence which does not die with the man but lives on.

SOIL EXPERIMENTS ON CALDWELL FIELD

Professor T. L. Lyon

THE field came into the possession of the University in 1903. It was part of a farm belonging to Mr. Mitchell and this part of the college land sometimes goes by the name of the Mitchell farm. That division of the farm which has been enclosed by a high wire fence and set apart for experiments contains forty-five acres. It is this area that has been given the name Caldwell Field.

The surface of the field is rolling, which quality it shares with most of the college land, and indeed, with most of southern New York. It is not an ideal piece of ground for the purpose intended, but it is the best that the College owned at the time it was selected for its present use. The soil is a rather heavy clay requiring very careful management to prevent it from becoming compact. When properly worked it produces most excellent crops of hay, wheat and other small grains, but is not well adapted to corn and potatoes unless very heavily manured. Being undulating in topography, the surface has been washed and eroded carrying the organic matter to the lower levels, exposing clay in places and causing it to be quite non-uniform in productivity. It might be considered that this would unfit it for experiments in which the yields of crops on small areas of land are to be taken to be indicative of a certain variety of plant or of a special kind of fertilizer. It is true that it makes experimentation more difficult than might be the case on some fields, but we have now come to realize that no area of land is uniform, notwithstanding the fact that it may appear so to the casual observer, and difficulties of the kind that exist here serve to keep the experimenter alert to combat possible error, which is an excellent state of mind for him to maintain. It means that methods must be devised for preventing error and this is now one of the most important phases of field plat experimentation in all those parts of the world in which work of this nature is conducted.

GENERAL VIEW OF SOIL PLATS.

THE EXPERIMENTS FOR SOIL STUDY

The object sought in almost all of the experiments conducted by the Department of Soil Technology is to ascertain the effect of some particular method of soil treatment on some property of the soil. The treatment may consist of a particular form of tillage or manure or of plant growth and the effect on the soil may be measured by the yield of the plants grown on it, or by some property that

is measured by chemical or bacteriological methods. If the yield of crop is taken as the indicator there must be some comparison between the tested treatment and some standard treatment in order that the effect of the treatment that it is desired to test shall be determined. A difficulty that always presents itself is to know that the result of the comparison is really due to the factors controlled by the experimenter, and not to contributing causes that were not intentionally introduced.

If we take a measured area of soil and apply a certain fertilizer to it the resulting crop may be greater or less than that which grows on a contiguous plat of the same dimensions and treated in the same way. A discrepancy is usually due to inherent differences in the soil of a part or all of the two areas. It occurs on all land, but on some fields the difference will be more than on others. There are two ways in which the difficulty may be decreased, one of which is to use a larger area of land for each test and the other is to multiply the number of tests at different places in the field, the object of both being to secure an average soil.

On this field the system of using small plats and multiplying them has been used as experiments with large and small plats on the field have shown that greater accuracy can be obtained with four plats of one hundredth acre each scattered over the area used in an experiment, than with only one plat one tenth acre in size. This, of course, means a great economy of space. As another precaution a standard treatment is given every third plat and each test plat is compared with the standard plats nearest it. The system is shown in the accompanying diagram.

Almost all of the one hundredth acre plats are now tile drained. The main drains, which are composed of four or six-inch tiles, follow the roadways. The laterals, of three-inch tile, are laid between every other plat, making a distance of twenty-four feet between laterals. By this arrangement all plats receive the same drainage.

In the roadways at the east and west ends of the rows of plats concrete monuments are buried in the ground to mark the line of plats and from these the location of each plat may be determined. These monuments are three feet high, eighteen inches square at the base and six inches at the top. On the top are two bisecting lines and from the point of intersection the corners of the plats may be located.

TANKS FOR SOIL INVESTIGATION

One of the difficulties that has always been experienced in conducting experiments with soils has been to maintain, in the soil under experimentation, conditions similar to those in the field. To meet these requirements a series of large concrete tanks has been constructed. Each tank is four feet two inches square with a maximum depth of four feet six inches and a minimum depth of four feet. The capacity of a tank is about three and one-half tons of soil. There are twenty-four tanks placed in two rows of twelve tanks each. Between the rows of tanks is a tunnel and from the bottom of each tank a tube for carrying off the drainage water runs into the tunnel. The drainage water is collected in galvanized iron cylinders which are also measures, and the volume of the drainage water and its composition are determined.

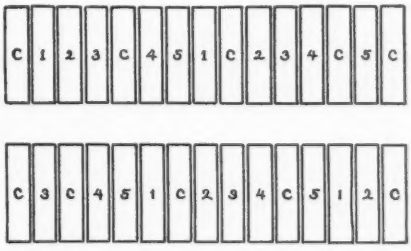

FIG. I. ARRANGEMENT OF PLATS FOR A SERIES OF FIVE TESTS.

C indicates check, or untreated plats; numerals indicates test plats. Each test repeated on the plats bearing the same number, making four replicate plats.

MONUMENTS MARKING THE LINES OF THE PLATS.

In the process of filling, the funnel-shaped bottom of each tank was first filled with sand. The soil from the fourth foot in depth, as the soil lay in the field, was then placed in a corresponding position in the tank, then the third foot, the second foot and finally the surface foot so that the soil layers were in their natural positions. The volume of soil is large enough to pack firmly after it has stood for some months, and the temperature and moisture content are similar to those of the surrounding soil. It is quite probable that the biological and chemical processes of the soil in these tanks are analagous to those which occur under field conditions.

The experiment was undertaken for the purpose of studying the conditions under which lime is lost from the soil and the changes that accompany it. A loss of lime develops a sour condition of the soil that is injurious to most of the ordinary farm crops. It has been found in the course of these experiments that less lime is removed from the soil when plants grow on it than when it is unplanted even including the lime removed by the plants. The reason for this is that nitric acid is continually being produced in the soil by certain bacteria and this acid unites with lime to form a soluble compound that is carried off in the drainage water unless prevented by the growth of plants that absorb the nitric acid through their roots and leave most of the lime in the soil in an insoluble condition.

A series of plats on similar soil are treated in a manner to duplicate the experiments in the tanks. This is done for the purpose of ascertaining whether the changes in the soil through a series of years correspond under the conditions of the field and tanks. In the tanks no upward movement of soil water is possible below a depth of four feet. In the field there may be such a movement brought about by the rise of water in the soil or by other agents. These field plats are maintained as a check on the tank experiments.

THE APPARENT INFLUENCE OF SOME HIGHER PLANTS ON CERTAIN BACTERIOLOGICAL PROCESSES IN THE SOIL

Determinations of the nitrate nitrogen content of soils on which maize, oats and timothy were growing showed that each is characterized by a distinctive relation to the soil nitrates, these always being highest under

maize, next under oats and lowest under timothy. In order to reduce the error due to inherent differences in the nitrate forming properties of the soils of the different plats the nitrate content of the soil under each crop was compared with an unplanted section occupying about the middle third of each plat. Nitrates under maize were sometimes higher than in the unplanted soil during certain stages in the growth of this crop. They then rapidly decreased in quantity with the ripening of the plants and did not again recover until the land was plowed. Under oats the nitrates gradually declined after growth started, and at harvest were generally lower than under maize when the latter was mature. Although oats are harvested here early in August the nitrates never rose materially during the remainder of the summer and autumn if the stubble was allowed to remain undisturbed. Oat land plowed after harvest and a part planted to maize increased more rapidly in nitrates in the planted than in the unplanted soil.

Timothy soil possessed a uniformly low content of nitrates throughout the entire growing season. These phenomena together with laboratory investigations may be explained on the hypotheses, (1) that certain plants during their early stages of growth have a stimulating influence on nitrate formation in the soil; (2) that during the later stages of growth certain plants exert a depressing action on the process of nitrate formation.

This influence of higher plants on the biological processes of the soil is a new conception and the means through which it is carried out must be discovered before it can be fully demonstrated. This part of the investigation is now in progress.

Another feature of this subject is the possible influence that a crop may exert on the process of nitrate formation during the year following its growth. Experiments in this field have given some indication that such an influence obtains, but it has not been fully demonstrated. It is possible that this is one of the factors in crop rotations.

NITROGEN BALANCE UNDER TIMOTHY AND UNDER ALFALFA

It is now well known that organisms exist in the soil that are capable of transferring the gaseous nitrogen of the air into the form or organic matter. Certain of these organisms live in nodules on the roots of leguminous plants like clover and alfalfa; others exist in the soil without any apparent relation to higher plants. Both may contribute to the nitrogen supply of the soil, a thing much to be desired, because nitrogenous fertilizers are the most expensive ones that the farmer has to buy.

It is generally considered that the organisms' associated legumes are more active in securing nitrogen than are the other kind. This is the accepted reason for the benefit derived from the growth of legumes. Plants like alfalfa and clover are very rich in nitrogen and as they yield large crops they require very large quantities of nitrogen for their growth. But legumes may absorb the combined nitrogen of the soil and incorporate this in the plant tissue, and sometimes when the soil supply of nitrogen is large they apparently utilize it to a great extent. The conditions under which legumes leave a considerable balance of nitrogen in the soil is, therefore, a subject that deserves investigation. Alfalfa is being used as a permanent crop and plats are being fertilized in different ways and also limed to see whether large yields and good fertilization are conducive to a large nitrogen balance in the soil.

Experiments on Caldwell Field have shown that soil on which alfalfa has grown for a number of years nitrifies more quickly than does soil on which timothy has grown for an equal length of time, although analyses of the two soils showed little difference in the quantities of nitrogen they contained. The land had raised the

TUNNEL UNDER SOIL TANKS SHOWING THE GALVANIZED CYLINDERS INTO WHICH THE DRAINAGE FROM THE SOIL TANKS IS RECEIVED.

two crops for six years before they were plowed up. No analyses of the soil before planting are available; hence it is impossible to say that one plat had or had not gained more nitrogen than the other, but the data raise the question whether the large removal of nitrogen from the soil by crops like alfalfa sometimes results in a nitrogen balance not greater than that remaining after timothy, and whether the better growth of crops after the legume may not be due to the more ready availability of the soil nitrogen following the growth of that crop rather than to the higher nitrogen content of the soil. Investigations covering these questions are now being conducted with both timothy and alfalfa under different fertilizer treatments and with and without lime, analyses of the soil having been made before the experiment was begun.

THE USE OF FERTILIZERS ON TIMOTHY

In recognition of the importance of the growth of timothy, in respect to which New York exceeds all the other States, a number of experiments with timothy alone and with timothy and clover are under way. A series of plats with timothy in rotation with corn, oats and wheat have been under experiment for nine years. These serve as a good illustration of the benefit that timothy may derive from top dressing it with commercial fertilizers or with farm manure. Yields of four tons per acre have been secured by this means on land that without such treatment gave only one and one-fourth tons. The net gain per acre from use of commercial fertilizers in their most profitable combination amounted to $65 for the six-year rotation and the most profitable quantity of farm manure gave a net return of $78. The hay crops only were

fertilized and the plats giving the largest yields of timothy produced the best grain crops.

Experiments now in progress are designed to show to what extent clover grown with timothy can take the place of nitrogen in the fertilizer, also whether it is more profitable in a rotation to fertilize only the hay crops, or only the grain crops or to fertilize both.

The experiments have also illustrated the fact that mineral fertilizers may be made to contribute large quantities of organic matter to the soil through the larger quantity of sod that is formed on the timothy land to which they are applied. As farm manure is a product that will probably not increase much in output, the problem of securing organic matter for the soil is an important one.

TOP DRESSING ALFALFA

Alfalfa that had been seeded down for six years was used for an experiment in top dressing. A set of plats were top dressed with farm manure, another set with a mixture of one hundred pounds acid phosphate and sixteen pounds muriate of potash, and still another set with one hundred pounds of acid phosphate alone. All of these treatments increased the yields over the untreated plats, but only the commercial fertilizers proved profitable, in which respect the acid phosphate was superior to the combination of that fertilizer and muriate of potash.

TESTS OF ACID PHOSPHATE AND RAW ROCK PHOSPHATE

This is a test of the effect of acid phosphate and raw rock phosphate on the yields of certain crops, when these fertilizers are used with fairly heavy applications of farm manure, and when used with only mineral fertilizers, as for instance, nitrate of soda and muriate of potash. It is particularly desired to ascertain whether the incorporation of farm manure under these conditions increases the effectiveness of the raw phosphate.

A six-year rotation is in progress of which the courses are maize, oats, wheat each one year and hay three years. Plats receiving the raw phosphate have a three-years' supply applied before seeding to grass. The grain crops receive this fertilizer annually and all crops receive acid phosphate annually. Farm manure is applied to the grass and corn at the rate of fifteen tons per acre.

EXPERIMENTS WITH DIFFERENT FORMS OF LIME

Lime may be purchased in the form of burned lime or in the form of limestone, which instead of being burnedis ground to a powder. The relative cost of these forms of lime varies in different localities, but it is desirable to know something of their relative efficiency in providing the soil with the basic material for which the lime is valuable. Another consideration is the degree of fineness of the ground limestone. Obviously the smaller the particles the greater the surface exposed to the solvent liquids in the soil. Burned lime does not need to be ground but slakes when it is added to the soil. Three sizes of limestone particles are used in the experiment. The size is determined by the sieve that the particles will pass through, the sieves having respectively ten, fifty and two hundred meshes to the inch.

In addition to the forms of lime already mentioned, gypsum, marl, dolomite, magnesite and Solvay lime are being tested. The last named is a mixture of oxide and hydrate. Ground limestone is also being used in different quantities per acre, as is also caustic lime. Applications of these substances have only been made once except on the plats that are receiving burned lime biennially.

Sorghum, oats and wheat have been raised on the flats treated with these various forms of lime. No legumes and no sod crops are being used as they might introduce secondary effects occasioned by the manurial value of the residue remaining from the crop. The organic matter in the soil is

FIG. 6—EFFECT OF FERTILIZER TREATMENT ON YIELD OF TIMOTHY HAY.

160 lbs. nitrate of soda 80 " muriate of potash 320 " acid phosphate 4310 " hay per acre	No fertilizer 2110 lbs. hay per acre	320 lbs. nitrate of soda 80 " muriate of potash 320 " acid phosphate 6610 " hay per acre

maintained by the use of farm manure.

The chief differences brought out by the experiment so far are the better yields on the plats treated with caustic lime than on those treated with ground limestone, and the depression of plant growth on the plats receiving magnesite. As this is a heavy clay soil the burned lime might be expected to have an ameliorating effect on the structure.

CONTINUOUS CROPPING WITHOUT MANURES

This is an experiment designed to ascertain the effect on the productivity of this soil when it is cropped continuously without replacing any of the mineral nutrients removed in the crops. It is intended, however, to maintain a liberal quantity of organic matter in the soil by means of grass or legumes. Thus a series of five plats will each year have three of the plats in timothy, one plat in maize and one in oats seeded with timothy. The next year the maize plat will be seeded and one of the timothy plats will be planted to maize. In this way each plat will be in timothy three years, maize one year and oats and timothy seeding one year. In another series the seeded crop is alfalfa, and in another series it is timothy and clover. Each series is duplicated.

The feature in this experiment in which it differs from continuous cropping experiments generally conducted is in the attempt at the maintenance of the supply of organic matter without the addition of any mineral nutrients. An incidental result of the experiment will be to compare the manurial value of timothy, alfalfa and timothy and clover sod. It will, of course, be a great many years before the data begin to contribute to the main object of the experiment.

HIGH GRADE NITROGEN FERTILIZERS

The value of nitrate of soda applied to timothy on this soil has been well demonstrated. It is now intended to test two other high grade carriers of nitrogen in comparison with nitrate of soda in a rotation, but particularly on timothy hay. The fertilizers being tested are ammonium sulphate and calcium cyanamid. The latter is of recent invention, but is now being extensively manufactured in Europe, and to some extent in this country. In its manufacture atmospheric nitro-

gen is the source of supply. As commercial fertilizers heretofore made use only of the combined nitrogen provided by nature, the supply of which must ultimately become exhausted, the production of a fertilizer made by fixing atmospheric nitrogen is a matter of great importance.

Ammonium sulphate has a constantly increasing output, as it is a by-product in the manufacture of illuminating gas and in the production of coke, and while formerly wasted is now being saved by a constantly increasing number of these plants.

These two fertilizers are being tested singly and in combination with sodium nitrate. As is customary where a single fertilizer ingredient is to be tested the other ingredients are used in excessive quantities. No definite results have yet been obtained.

INVESTIGATIONS CONDUCTED BY THE DEPARTMENT OF PLANT-BREEDING

By Dr. H. H. Love and Dr. C. H. Myers

THE Plant-Breeding Department was organized in 1907 and supported entirely by Hatch and Adams funds.

The primary object of the department was to work upon the principles and methods underlying the general subject of plant-breeding or plant evolution. As time has passed the work has developed in two general lines. One, which may be called practical, is the development of better yielding strains of the various farm crops for distribution among the farmers of the state; and the other, scientific, consists of work on the principles and laws which form the basis for plant improvement.

Since it has been the primary object of the department to work on the scientific phases of the subject of plant-breeding, the plants with which the work has been done have been both of economic importance and of no economic value. That is, when it has been possible to use some wild plant or weed with greater economy this has been done. For example, the chickweed (*Stellaria media*) has been used as a plant with which to study the influence of environment. The facts obtained from such experimentation are of course, applicable to the economic crops, and, therefore, the problems have not been conducted in vain.

At the present time the research work of the department is divided between two professors, who with their assistants are conducting the experiments. The division of the work between these two men has been largely along the line of crops; each man specializing with different crops. This is especially true in the case of the problems of economic importance.

THE WORK WITH TIMOTHY

The timothy breeding work at Cornell was started in 1903 by Professor T. F. Hunt. He was assisted in this work by Professor J. W. Gilmore, Samuel Fraser, and Dr. C. F. Clark. Dr. H. J. Webber was placed in charge of the work in 1907 and continued the direction of the experiment until he severed his connection with the College in 1913.

In the beginning a large number of letters were sent to agricultural workers in all parts of the civilized world, asking for a small quantity of timothy seed. In this manner seed was obtained from more than two hundred places. The larger number of these lots was from the United States, but there were a goodly number of samples from foreign countries, including Austria,

GENERAL VIEW OF PLANT BREEDING GARDENS.

Canada, Denmark, Ireland, England, Norway, Germany, Scotland, Hungary, Sweden, and Switzerland. The purpose of collecting all of these lots of seed was to take an inventory, as it were, of this important member of the grass family, to see of just what it was constituted in the way of types and strains.

After this seed had been collected, a portion of each of the different samples was sown in pots of sterilized soil in the greenhouse. The soil was sterilized in order that no stray seed of timothy could germinate along with the seed that was sown there. After the seedlings had reached a sufficient growth, they were transplanted to the field in rows three feet apart each way. It has since been found more convenient to make the rows four feet apart and to place the plants three feet apart in the row. By having these arranged in this manner there is opportunity for the plants to develop to the fullest extent, and they may also be observed to better advantage. (See Fig. 2). In this fisrt planting there were 12,516 plants.

Up to that time no varieties of timothy had been isolated. "Timothy was timothy," and about the only effort towards improvement was to get bright, well cleaned seed. But, when a careful study was made of these several thousands of plants grown separately, great variation was found. Following are some of the characters observed: height of plant as tall or dwarf; erect and spreading habit; fine stems; coarse stems; scant foliage; dense foliage; wide leaves, narrow leaves; variation in color of stems, heads, and leaves; slender heads; short, blunt heads, cylindrical heads, nodding heads (Fig. 1); date of maturity; length of blooming period; amount of aftergrowth, rust resistance, and the like.

In order to study these variations of single plants more carefully, the selected plant was propagated vegetatively by cuttings or slips of the bulbs formed in the stooling. In this manner a large number of plants can be obtained which are in reality transplanted parts of the same individual. It is possible that bud variation may occur among these cuttings from the same plant. Experiments are now in progress to determine the amount of this. But in general, the clons (cuttings) from a single parental plant are quite uniform, and they furnish an excellent means for a more complete study of different types.

The important thing the plant-breeder has to determine about the characteristics of any crop with which he is working is to what extent they are transmitted to the offspring. The variations that are not inherited are of no particular value.

In order to study the transmission of these different types, inbred seed was obtained by covering a bunch of heads with a paper bag before blooming time. This inbred seed was carefully germinated in flats of sterilized soil, and the young seedlings were transplanted to the field in the manner previously described. In this test were included a large number of promising hay types as well as many others of no apparent value. The latter were included for their scientific interest. Not all of the varying characters observed in the original selections were inherited, but there have been more than two hundred and fifty definite types of timothy isolated.

It should be observed in this connection that timothy is an open-fertilized plant, and consequently none of these types is absolutely pure in the sense of the pure line theory. They are probably only pure for certain gross characters.

As soon as the seed transmission of desirable types was determined, the next thing in order was to increase the seed of the promising types, so that they could be tested in broadcast plats in comparison with each other and with commercial seed. To do this, either inbred seed or cuttings from the desired types were planted in isolated beds. These beds should be, at least, two hundred feet

apart, and it is still better if they can be surrounded by some tall growing crop, such as rye. In these beds the plants were placed eighteen inches apart each way so as to allow of some cultivation. Such a bed, containing four to five hundred plants, under proper conditions, furnishes from two to three bushels of seed, and with some care can be maintained for a number of years, thus furnishing a constant pure supply.

A large number of varieties have thus been tested in fortieth acre broadcast plats (Fig. 3), some for four years, some for two, and still others have produced but one cutting. As rapidly as possible others will be placed in the test to replace those which have failed to show their superiority. A broadcast test, to be of value, should continue for a period of from four to six years.

From the series of plats which have been grown for four years, some gratifying results have been obtained. In this test, including sixteen new varieties, the four year average gain of the five best varieties over their checks has been 2100 pounds per acre. Five others have given over 1000 pounds per acre average increase, five others have ranged between 284 and 975 pounds per acre, while one was inferior to its check. In each case the check used was the best grade of commercial seed available. Equally promising results are given by the later series of plats, but they need to be grown two or three years longer before definite conclusions can be drawn.

The next problem in this work is a further test of these new varieties under other conditions and the increasing of the seed so that it may be available in commercial quantities. This is being accomplished by coöperative tests and by the distribution of small amounts of seed to applicants who are willing to handle it carefully. Only a beginning has been made in this work, but so far it gives promise of excellent results. It is expected that

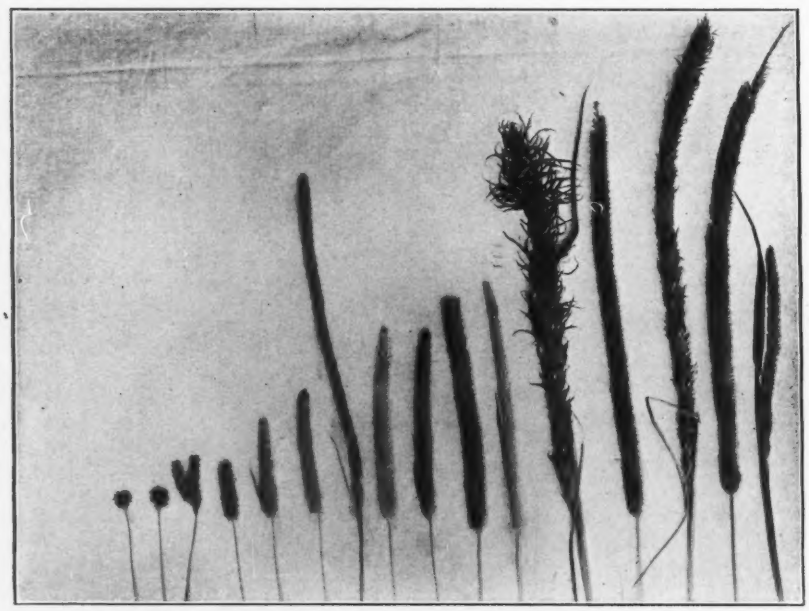

FIG. 1—VARIATION IN LENGTH OF TIMOTHY HEADS.

FIG. 2—AN EXPERIMENTAL FIELD OF INDIVIDUAL TIMOTHY PLANTS.

within a comparatively short time the best of these new varieties will be avaliable in commercial quantities for general use.

The further testing of new varieties will be continued. In addition to this there remain many problems of scientific interest. One of the most interesting of these is the one of bud variation, previously mentioned. From the biometrical standpoint the correlation of various characters will furnish interesting material for study. As yet no hybridization studies have been made. These should furnish material for a study of the analysis of unit characters. These and other problems will continue to add considerable scientific interest to these experiments, which are already of so much practical value.

POTATO BREEDING

The potato breeding work was begun in 1908 by Dr. Webber. The experiment was designed primarily for a scientific study of bud variation, and the effect of selection within pure tuber lines. Incidentally, it has thrown light upon some of the practical methods of hill selection.

The method of starting this experiment was very much like that used with the timothy. First, a large number of different commercial varieties were obtained from various sources. These sources were not as widely distributed as those from which the timothy came, but they represented a large variety of conditions.

From these lots of seed individual tubers were planted by a four hill unit method or by some modification of this method, so that the progeny of each tuber was kept separate. This system has been followed year after year, so that now each parental tuber is represented by a large progeny. These progenies constitute the pure lines. A careful study has been made

FIG. 3—VIEW OF THE BROADCAST TIMOTHY PLATS.

of the characteristics of the parental tubers as well as of the pure lines coming from those parents. In every case the propagation has been made by cuttings. Thus the variations that occur must be bud variations.

The experiment has not been conducted sufficiently long to warrant the publication of many definite conclusions. However, some interesting and suggestive observations have been made. It might be expected that the offspring of a single parental tuber, propagated by cuttings, would be uniformly true to the parental type. This seems to be true to a certain extent. The pure tuber lines are remarkably uniform in regard to habit of growth, vigor, yielding capacity, shape and color of tuber and the like. But within these pure tuber lines there have occurred variations pronounced and definite enough to constitute a new line, and the progeny of this line has continued true to the new type (Fig. 4). In this manner there have been isolated a good yielding, a medium yielding, and a poor yielding strain, all from the same pure line. This kind of variation has also occurred with respect to the shape, size, and color of the tuber.

In this experiment a comparison has been made between the apical (seed) and basal (stem) end of each tuber. It has been observed that a large number of the low yielding or degenerate strains have sprung from the basal cuts. To draw a practical comparison, in a test of twenty-two varieties for two years, the apical hills gave an average yield of 180 bushels per acre, while the basal hills yielded 151 bushels.

More data will be accumulated in regard to the amount and nature of the bud variation within these pure lines. The results herein given can only be considered as preliminary. Several years more must elapse before

any definite information will be available concerning the accumulative effect of selection within a pure line.

From the practical standpoint the experiment has justified the method of hill selection for the improvement of potatoes. Although these offshoots of varying types occur they probably are infrequent enough to be of little consequence to the grower who is practicing hill selection. As an example of this, the four year average of selections from three low yielding strains is 93.8 bushels per acre as against 231.3 bushels per acre for the selections from three high yielding strains. Several promising strains have been isolated. These will be tested in comparison with commercial varieties, and if they prove superior will be distributed for general use.

NUTRITION STUDIES

In the Plant-Breeding Garden are three series of beds, planned for the purpose of a long time experiment on the effect of growing plants under different degrees of fertility (Fig. 5). In each series there is a bed of sand, one of ordinary garden soil and another of highly fertilized soil. Seed from the same plants are sown on each bed of a series and pedigree records are kept, so that the inheritance from year to year can be traced. Statistical measurements of each crop are taken and are biometrically treated.

The study is divided into three parts. First, the variation that occurs under these different conditions; second, the effect of these conditions on the correlation of various characters; third, the inheritance of charac-

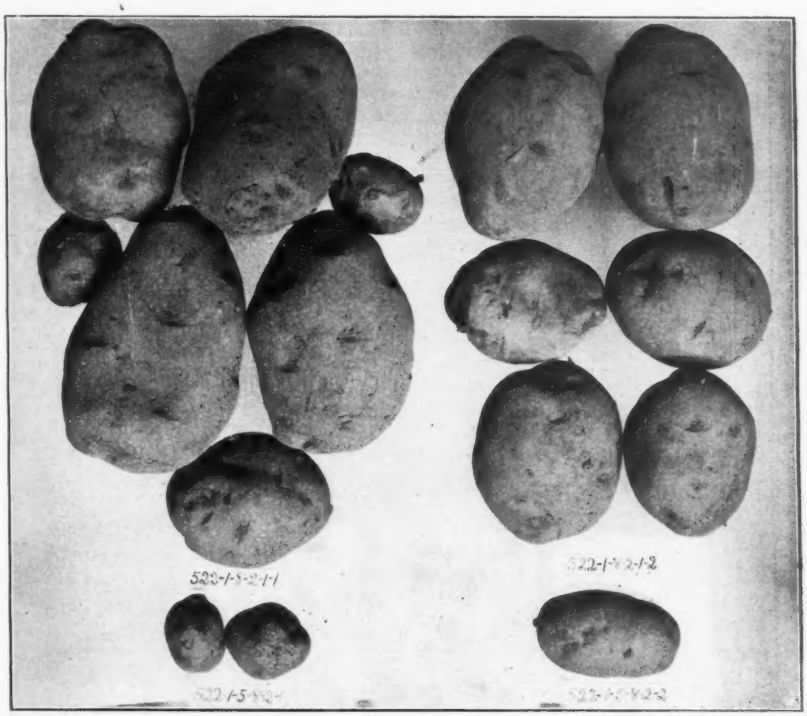

FIG. 4—VARIATION OF YIELDING CAPACITY WITHIN A PURE TUBER LINE OF RURAL NEW YORKER. TWO UPPER HILLS, GOOD YIELD; LOWER HILLS, POOR YIELD.

ters from year to year under different conditions of fertility. There is a practical consideration in this connection upon which the experiment will shed light. That is the practice, fairly common among seedsmen, of producing seed under conditions which are more favorable than those under which it will be used. No publication of conclusions can be given until five or more years of data have been accumulated.

CORN BREEDING

Corn breeding experiments have been conducted by this Department with coöperators on farms located in different parts of the state. Selection plats of Pride of the North, at Aurora, and Funk's Ninety Day, at Ballston Lake, have been under way for five years.

At Bedford Hills an experiment in the selection of Funk's Ninety Day is also being conducted, having been started in 1910, from seed of the plat at Ballston Lake. In fact, the seed from the ears which were used for planting the Ballston Lake plat in 1910 was divided and part of each ear was planted at Bedford Hills and part at Ballston Lake.

The main object of these experiments is to obtain earlier varieties of corn which will mature seed under New York conditions and also give a high yield of grain (Fig. 6). These different sorts are responding to the selection for earliness very markedly. The effect of selection was well demonstrated in the following manner at the Ballston Lake plat in 1911. A general lot of select seed was obtained by taking a small quantity of seed from each of the ears selected for planting. This was used to compare the gain in earliness by planting it in alternate rows with the original seed with which the selection was started. The original seed used in the test was obtained by mixing kernels from each of the ears planted in starting the selection the first year, 1908. The crop from these alternate rows was harvested and carefully compared with reference to earliness. It

FIG. 5—VIEW OF NUTRITION PLATS IN PLANT BREEDING GARDEN.

was found that in the rows grown from the improved seed 72 per cent of the ears were fully ripe when husked, while in rows grown from the original seed only 13 per cent of the ears were graded as ripe and, in fact, these few were not so ripe as the ripe ears of the dent corn which will mature seed would be of as great value for silage purposes as strains which are later and do not mature seed under New York conditions. With this in mind an experiment was started in 1911 to compare the silage value of these

FIG. 6—METHOD OF SORTING BREEDING EARS OF CORN INTO RIPE AND UNRIPE PILES IN ORDER TO SELECT FOR EARLY MATURITY. RIPE EARS TO THE LEFT, UNRIPE ON THE RIGHT.

improved strain. This degree in ripeness so far as could be judged by observation represents a gain of at least two weeks in earliness or time of maturing. During the selection careful attention has also been given to productivity, and the early strain remains fully as productive as the original.

In connection with this corn breeding work it is thought well to determine whether these new strains of selected sorts with some of the common silage corn. This experiment is still being continued. It is thought that such a study conducted for two or three years will show whether it is possible to obtain an all-purpose variety; in other words a variety which will be desirable both for silage and grain.

While these breeding tests have been under way many notes hav

been taken on the parent ears, to learn if possible whether there are any visible seed ear characters which may indicate high yield or earliness. Such notes as length, weight, circumference of ear, weight of grain, percentage of grain, length and breadth of the kernels and the like, have been taken and will be correlated with yield. If any of these characters indicate a high yielding strain, then it will be possible to use these in seed corn selection, thus adding to the possibility of obtaining higher yields.

None of these corn experiments has as yet been completed, but the selection for earliness and high production has proceeded far enough so that some of the seed of these earlier sorts is being distributed to the farmers for a further test.

CEREAL BREEDING INVESTIGATIONS

Oat breeding. The experiments in the breeding of oats have been under way since 1907. The earlier work consisted of making yield tests of a large number of hybrids and selections from commercial varieties which had been made by J. B. Norton, of the Bureau of Plant Industry, U. S. Department of Agriculture. The method used for making these yield comparisons has been the so-called rod row system (Fig. 7). This system consists of planting the grain one foot apart in rows about one rod in length. The different strains are repeated a number of times in the test, that is, there are several rows of the same strain growing in different parts of the field.

When the work had been under way long enough to judge which strains were the best yielding ones the poorer sorts were discarded and many commercial varieties were brought into the test to compare with the hybrids and selections. This is still being done.

The results obtained from these tests have shown the possibility of increasing the yield of oats by selection and hybridization. This is clearly shown in the following table. The yields of the new sorts are directly compared with the yields of the commercial varieties from which they were obtained.

It will be seen that the Welcome selection shows a gain of 14.3 bushels per acre over the variety. Two selections from the Sixty Day variety made gains of 11.9 and 9.6 bushels per acre, respectively, over the yield of the variety. The average yield for the Burt and Sixty Day varieties was 46.6 bushels, while the hybrid between the two yielded 57.7 bushels, giving a gain of 11.1 bushels per acre in favor of the hybrid.

Since the work was begun many new selections have been made from

TABLE 1.

SHOWING COMPARATIVE YIELDS OF SELECTIONS AND HYBRIDS, AND THE COMMERCIAL VARIETIES FROM WHICH THEY WERE OBTAINED.

VARIETY OR STRAIN	Yield in bushels per acre	
	2 year average	Gain
Welcome variety	*50.7	.....
123–5, selection from Welcome variety	*65.0	14.3
Sixty Day variety	43.9	.....
Selection from Sixty Day variety	55.8	11.9
Selection from Sixty Day variety	53.5	9.6
Sixty Day variety	43.9	.....
Burt Variety	49.3	.....
Average of Sixty Day and Burt	46.6	.....
Burt x Sixty Day	57.7	11.1

*Three year average.

different commercial varieties. These are now being tested to determine their value as high yielders when compared with the varieties from which they were selected and also with other commercial varieties.

These selections were made in two ways. One method was to go into a field of oats and select a large number of good heads. Care was taken to make these selections from the field where the seeding was normal and where the plants were not favored by more moisture or plant food. The other method was to grow a great many plants of the same variety in a plat where each plant had the same amount of space in which to develop. The plan of planting followed was to mark the ground into squares one foot apart each way and then plant a seed in a place. This plan gives each plant an equal chance in the field and makes it possible to select an entire plant which will give more seed with which to begin the selection than is possible when only a single head is selected from the field. These heads or plants are now multiplied either in head-rows or plant-rows as the case may be and then put into the regular test. In every case a composite lot of seed of the variety from which the selection was made is grown in order to compare the selection with the variety, and only those selections which yield better than the varieties themselves are saved.

A great many new hybrids of oats have been made. These consist of a large number of crosses of widely different varieties. The primary object of this work is to make a careful study of the Mendelian segregation and inheritance of the different characters. This experiment is not completed so that no definite statements can be made as to the final results. Throughout the experiment the practical value of the new types obtained through crossing will be studied so that if any new combinations are of value as high yielders they will be multiplied and used as such.

Any new high yielding strains are

FIG. 7—HARVESTING ROD ROWS OF OATS.

GENERAL VIEW OF WHEAT BREEDING PLATS.

to be distributed to the farmers for further seed testing and later put out as seed in a commercial way. Some distribution has already been made.

Another line of investigation with oats has been that of the study of correlations. It has seemed advisable to study the different measurable characters of the oat plant to determine if possible whether any of the general characters may be correlated with high yield to such an extent that they may be kept in mind when making selections or passing judgment on different strains of oats. This experiment has not been conducted long enough to draw any definite conclusions.

While studying these correlations the question arose as to whether environment may not have a very marked effect on the amount of correlation. With this in mind a coöperative experiment was begun with the Montana Experiment Station. The same pure line of oats is being grown at both places and the same characters are being studied. This experiment will be continued for some time.

Wheat breeding. The work in wheat breeding is along the same general lines as is the work with oats. For several years a large number of selections from some of the well known commercial varieties have been tested in regard to their ability to yield. These tests have been made in a manner similar to those of oats, that is, by using the rod row system. The poorer strains have gradually been eliminated from year to year, until now only a few of the higher yielding ones remain. These are being compared with a large number of commercial varieties to determine whether any of them are superior to varieties already on the market. Results are now available which show that certain of these strains have given very good yields for the last four years. Some of the strains have given the following yields as an average for the years 1910–1913 inclusive, 39.1, 37.2, 36.9 bushels per acre.

The difference in quality is also an important point with wheat. For milling purposes a hard wheat is important, while for other purposes a softer wheat is more desirable. One of the aims of this work is to breed a good type of white wheat, which is the type desired by the Shredded Wheat Biscuit Company. Coöperative wheat breeding with this company and some farmers is now under way.

An extensive study in the hybridization of a large number of different varieties of wheat is also under way. The first generation of these hybrids will be grown in the greenhouse this winter. This study deals first, with the segregation and inheritance of characters and later, if any new sorts of a commercial value are obtained these will be distributed to the farmers of the state.

DAISY WORK

As stated in the beginning of this article, this department was established to work on principles and methods, and that sometimes plants of no economic value were used to make such studies. Such an experiment is that being conducted with the common field daisy (Fig. 8).

The main study with this plant is to isolate the many different types and determine what ones transmit their characters to their offspring. While observing daisies as they grow in the field it was noticed that there were many different types of plants. They differed in their habit of growth, as in stature, branching, and the like, as well as in their foliage characters. There were also great differences in regard to their flowers. Many of these forms have been isolated and vegetative rows of them have been planted. They are now being carefully studied and seed will be sown next year to determine what types produce their particular characters. This part of the study has proceeded far enough to know that there are certain characters which are transmitted.

Another study with the daisy is that of the effect of environment on

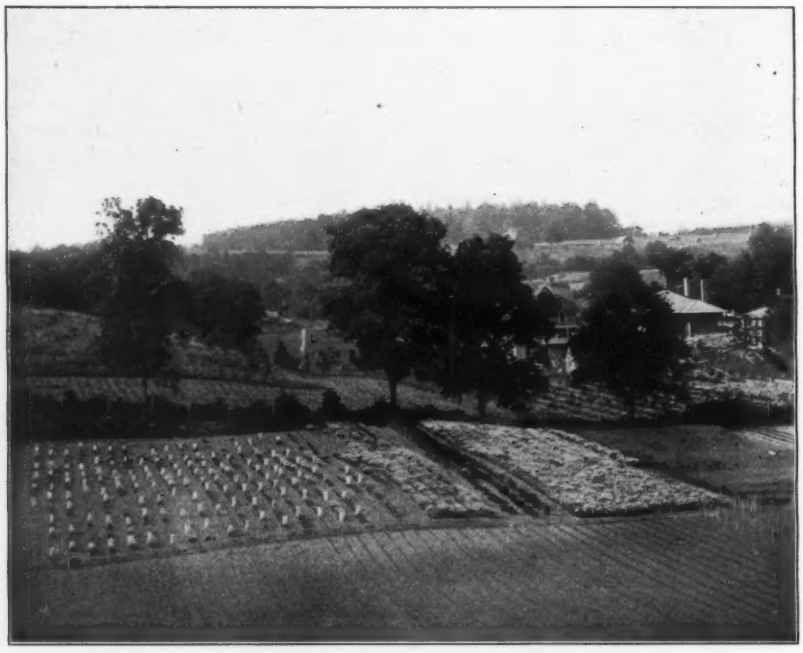

FIG. 8—GENERAL VIEW OF DAISY PLATS.

the ray-florets. Populations were collected from hill tops, valleys, and cultivated areas, to learn the difference in variation. Some very interesting data have been obtained, showing that some striking differences are found in the different localities.

Another study combining a determination of the place variation and the change in variation throughout the growing season has been under way for four years. In this study all the daisy heads from a given area are collected every day throughout the blooming season and the number of ray-florets on each head determined. There have been from 12,000 to 43,000 heads studied each year. Some striking changes have been observed, yet the studies are not complete enough to justify making any generalization at this time. However, there is a gradual decrease in the number of ray-florets as the season advances.

The Cornell Countryman

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OCTOBER, 1913

A Greeting

We are beginning a college year which promises to be eventful in many ways. The College of Agriculture has continued to grow during the summer, new buildings are rising about us, new faculty members have joined us with enviable reputations at other institutions, new departments have been organized, a new Acting Director has begun his administration.

The COUNTRYMAN extends a greeting to both the new and old students. In this busy college of ours there is opportunity for every one of you. We would remind you that you are not only here to gain a knowledge of scientific agriculture but to become real men and women. You have come to what a recent writer has called our "Welfare College" where the real problem is the human problem. Our college stands not only for better farming but for a better country life. We urge you to engage in her activities and get into the spirit of it all.

Do not forget that a great university has opened her doors to you as well as a great college of agriculture. A very essential factor in a successful college career is to be alive to your advantages while you are here.

Dean Bailey's Resignation

During the summer Dean Bailey resigned from the Directorship of the College of Agriculture, his resignation taking effect on July 31. The Agricultural Council at its meeting on July 26th adopted the following minute:

"In view of the fact that the present meeting of the council is the last during the incumbency of Director L. H. Bailey whose resignation takes place July 31, 1913, the council desires to express its regret at his resignation and express its appreciation of his services to the University and to the State of New York.

The council was called into being on the sixteenth of December, 1911, and was intended to represent the various interests of the state, the university and the college. Its members during the brief term of its existence have been brought into intimate relations with the director and have admired the breadth of his views and his grasp of the complicated business of the college.

The extraordinary growth of the college rendered possible by the enlightened bounty of the state, is in a large measure due to Director Bailey's genius and far reaching plans.

The personal intercourse of the council with the Director has been most pleasant and its members deeply

regret that official relations with him must cease. They trust, however, that their friendly connection strengthened by the co-operation of the last two years may continue unbroken, and that they may still enjoy for the sake of the University and College, Director Bailey's advice and sympathetic interest.

They wish finally to assure him that he takes with him into his well earned retirement their cordial wishes for his future usefulness and happiness."

The minute of the Agricultural College Council expresses also the sentiment of the student body. The student body has often expressed its regard for Director Bailey in more suitable ways for such a regard cannot be best expressed in type. The COUNTRYMAN whose valued friend Director Bailey has always been, wishes him many full and successful years.

A New Acting Director

On July 29, the Board of Trustees of the University, on the recommendation of the Agricultural College Council, appointed William Alonzo Stocking, jr., acting director of the College of Agriculture for one year or until a director is appointed permanently by the Board of Trustees.

Professor Stocking graduated from the Connecticut Agricultural College in 1895 with the degree of Bachelor of Agriculture and in 1898 received the degree of Bachelor of Science in Agriculture from Cornell University. From 1901 till 1904 while teaching at the Connecticut Agricultural College, he was registered as a graduate student at Cornell in dairy bacteriology receiving a master's degree in 1904. In 1906 he became assistant professor in Department of Dairy Industry at Cornell and three years later became a full professor. When Professor R. A. Pearson resigned as the head of the Department of Dairy Industry, Professor Stocking was appointed.

We extend a greeting to Acting Director Stocking and we assure him that he has the support and backing of the student body in his difficult task. Judging by his ability at the head of the Department of Dairy Industry, the College of Agriculture will continue on its successful career under his guidance.

An Experimental Number

This number is devoted to the experimental work which is being done at the college. All the experimental work which the college is doing could not be described in one issue, the articles describing just the work which is being carried on at the experimental field on the college farm, i.e. Caldwell Field.

Of the three functions of the college; teaching, extension and experimental work, the last is the most obscure. It is not a common practice among students or farmers to visit the experimental field so that very little is known of the different experiments until they are finished and the results published. The work done at Cornell can be favorably compared with that done at any of the agricultural colleges. There is much to be gained by a visit to Caldwell Field if only to study the experimental methods. Ex-Dean Bailey has often urged a better acquaintance with the college farm. We believe that this advice applies to

the experimental fields very strongly and that our present and future farmers of New York State should be more familiar with them.

A Competition

A competition is just starting for positions as Associate Editor and Assistant Manager of the COUNTRYMAN. There are to be three separate competitions, one for freshmen and one for sophomores on the editorial side and one for freshmen on the business side. All three competitions will be decided directly after the Christmas recess.

These competitions are fairly short and do not require previous experience. We believe they are worth while in themselves for the competitors. Here is a chance to get in touch with what is going on at the college, to make friends and to acquire a considerable amount of valuable knowledge. We urge you to come out and try.

The President of the University has just returned from Greece where he has served his country as Ambassador. THE COUNTRYMAN welcomes President Schurman back to Cornell.

BOOK REVIEWS

ROMAN FARM MANAGEMENT, a translation from the treatises of Cato and Varro by an anonymous author. 351 pages. Published by the Macmillan Co., 66 Fifth Ave., New York City. Price $2.00 net.

A very instructive and amusing book having considerable literary merit.

ANIMAL HUSBANDRY FOR SCHOOLS, by Professor M. W. Harper of Cornell University. Rural Text-Book Series. Illustrated. 398 pages. Published by the Macmillan Co., 66 Fifth Ave., New York City. Price $1.40 net.

This book covers admirably the subject of animal husbandry considering the space allowed. It is full of practical knowledge and exceptionally well illustrated.

THE COUNTRY CHURCH, by Charles Otis Gill and Gifford Pinchot. 219 pages. Published by the Macmillan Co., 66 Fifth Ave., New York City. Price, $1.25 net.

Giving the result of survey principles applied to the country church. Surveys were made in Tompkins County, New York and Windsor County, Vermont. This book is full of startling facts which should be of much value to students of country life.

ELECTRICITY FOR THE FARM AND HOME, by Frank Koester. The Farmer's Practical Library Series. 274 pages. Published by the Sturgis & Walton Company, New York. Price, $1.00 net.

Discusses the generation of electrical power, practicability and the use to which it can be put. It is well worth reading for its suggestive value.

CAMPUS NOTES

The Department of Vegetable Gardening begins this term as a separate department. Mr. Work will be superintendent of the department. Mr. Wilkinson will have charge of the extension work. C. E. Dimon, '13 and H. W. Schenck, Wisconsin '13, will be instructors and there is one position yet to be filled.

The courses are re-arranged so that students can specialize in the subject as well as to gain elementary knowledge. There will be a new course lasting all through the year in outdoor commercial gardening intended for specialists. The Department is building a new greenhouse, 34 by 50, which is the beginning of a teaching range to occupy the north side of the greenhouse compound and eventually there will be 12,000 square feet of glass.

The field work is to be done on the Bool farm. It was decided during the summer that the vegetable gardening field should be known as Craig Field. The students will work in the early soil of the East Ithaca garden.

* * *

A new Department of Botany has been organized in the college, under the leadership of Professor Weigand. It is planned to develop the department broadly so that in a few years it will represent all branches of botany. During the first year most of the attention will be given to the introductory course and the required course, afterwards the advanced and special courses will be developed. The Department will ultimately have a museum and a complete herbarium of wild and cultivated plants, weeds, etc. The Department will include the present Plant Physiology Department and will occupy its quarters and those of the Plant Pathology Department which has moved to the new Auditorium.

* * *

The Home Economics Department during the month of July had a car equipped belonging to the Lehigh Valley Railroad and offered to the College of Agriculture for extension purposes along its lines. The exhibition of the Department of Home Economics consisted of illustrative material showing the teaching of the department in foods, sanitation and household art. Demonstrations and lectures were given in the car each day for a period of three weeks. The car was moved to the State Fair at Syracuse with its equipment in Home Economics.

* * *

A building has been constructed for the Department of Plant Breeding for storing breeding rows of timothy, oats, wheat and other crops until they can be threshed. The building has a concrete floor and wire mesh sides, being rat and bird proof. A gasoline engine is used for power and the seed is threshed by small machines made especially for the purpose. This will greatly increase the efficiency of the plant breeding work.

* * *

The Student Loan Fund Committee was able to raise $500 last June as the nucleus of a permanent fund to be

administered by a faculty committee. At the meeting of the committee in June, R. C. Shoemaker, '14, was elected chairman for this year.

* * *

Ralph W. Curtis, B.S.A., '01, who was for four years assistant superintendent of the Arnold Arboretum of Harvard University at Jamaica Plains, Mass., has been appointed assistant professor of landscape art in the College of Agriculture. Professor Curtis was born at Burlington, Wis., in 1878. He entered Cornell with the class of 1900, but his course was interrupted by a year of absence and he graduated in 1901. Three years afterward he received the master's degree and was then, for a year, assistant in nature study in the College of Agriculture. He left Ithaca to become connected with the department of parks of Boston, Mass. In 1909, when assistant superintendent of parks, he resigned to accept an appointment as assistant superintendent of the Arnold Arboretum. Since April 1st last he has been in the office of Warren H. Manning, landscape architect, in Boston.

* * *

An organ has been ordered for the auditorium of the College of Agriculture, after a long and careful investigation by Dr. Andrew D. White and the trustees' committee on music. It will be built by the J. W. Steere Organ Company of Springfield, Mass., and will cost about $20,000. It is to be completed before April 2, 1914. The money for its purchase was given by Mr. Andrew Carnegie, Dr. White, and other friends of the University. Although it will be placed in a building belonging to the State of New York the understanding is that the organ will remain the property of the University.

* * *

The Plant Breeding Department is making plans for a demonstration car to be run in coöperation with the New York Central during the fall. Plans are also being made for a second distribution of timothy seed to applicants and for a distribution of seed from improved varieties of wheat.

* * *

The old poultry building near the Home Economics Building is being re-modeled for the use of the Landscape Art Department.

* * *

At the June meeting of the Board of Trustees Professor Frank B. Moody was appointed to fill a fifth professorship in the Department of Forestry. He was formerly Assistant Professor in Forestry at the University of Wisconsin, graduating from the University of Michigan in 1906. He was Assistant State Forester of Wisconsin from 1906–12. Professor Moody will have charge of the University Extension Work in Forestry and will give a course in the care of the farm woodlot.

* * *

Farmers Week will be held February 9–14.

* * *

The different departments in the college will be represented at 28 county fairs besides the state fair during the fall months.

* * *

The new Auditorium will be occupied this year by the Plant Pathology, Rural Economy and Vegetable Gardening Departments.

* * *

The attendance at the summer school this year showed an increase of 110 students, the total attendance being 333.

* * *

Mr. R. D. Anthony is assistant horticulturist at the Geneva Station.

* * *

Professor Edward A. White will have charge of the teaching in floriculture. Professor White comes from the Amherst Agricultural College. Professor Beal will have charge of the research work in the new Department of Floriculture.

* * *

Professor T. L. Lyon sailed September 20, for Germany, being on a sabbatical leave of absence. He will

make a thorough inspection of the German experiment stations spending most of his time at the University of Leipsic. Professor Lyon will also visit several French and English stations returning home at the beginning of the second term.

* * *

The Farm Crops Department has been conducting a potato survey this summer in charge of Mr. E. V. Hardenburg. A survey of Long Island was made beginning in June and survey of Steuben County was made in August. Although no figures have yet been obtained from the data, the results promise to be very successful in showing both the facts in regard to potato growers and the problems of the grower. Mr. Fox of the Farm Management Department has been figuring cost accounts in connection with this survey.

* *

The Soils Department has been making soil surveys in Chautauqua and Oneida Counties. The party in Chautauqua County is in charge of Mr. Morrison. Part of the county has already been surveyed and is now being re-surveyed. Mr. Maxon has charge of the party in Oneida County. The southern part of this county has already been surveyed.

* * *

Professor Chandler from the University of Missouri has arrived to do research work in pomology.

* * *

Mr. L. W. Arny will teach in the Department of Pomology this year. Mr. Arny is a graduate of Pennsylvania State College and has been connected with the Pennsylvania Farmer.

* * *

Mr. E. L. Markell of the Department of Pomology has taken a position with the Department of Pomology at Washington.

* * *

The class in "The School" which attended the Summer Session gave an extemporary drama August 7 in front of the Rural Schoolhouse. The play "Sleeping Beauty" was given as a demonstration of the idea of dramatic expression in children.

* * *

The Landscape Art Department has made a map of the grounds and farm belonging to the College of Agriculture. The map will furnish a basis for a permanent road system and the landscape work which is to be done.

* * *

The Department of Farm Mechanics has made a topographical survey of the grounds and farm belonging to the College of Agriculture.

* * *

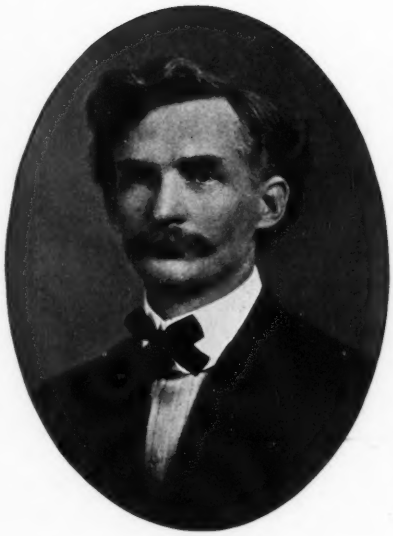
A summer meeting of potato growers was held on August 20 at the farm of T. E. Martin, West Rush. There was an attendance of 300 potato growers from all over the state and several men from the College, Professors Montgomery and Gilbert, Assistant Professors Myers, Barrus and Robb; Messrs. Hardenburg, Whitcomb, Wilkinson and Ladd.

Professor E. G. Montgomery was chairman of the meeting. Short talks were given and the meeting adjourned to the field where Mr. Martin explained a system of underdrainage which he has established. It is expected that during the coming winter a potato growers association will be formed.

* * *

Several of the Home Economics graduates of 1913 have been engaged as teachers of home economics for the next year. Miss Pearl Boynton will teach in the public schools of Medina, N. Y., Miss Dora Earl will teach home economics and science at the Pennsylvania State Normal School, Indiana, Pa. Miss Ruth Graham has been engaged as the teacher of domestic science at Stamford, N. Y., Miss Sarah Haswell in the public schools of LeRoy, N. Y., Miss Caroline Higgins has taken a position in the Massachusetts General Hospital, Boston; and Miss Celia M. McKay, in a State Institution, Syracuse. Miss Margaret Robinson has a position at Proctor Academy, Andover, N. H.

FORMER STUDENTS



L. C. CORBETT.

'90, B.S. in Agr., M.S. in Agr, '96.—Professor L. C. Corbett since early in March has been Assistant Chief of the Bureau of Plant Industry which is the largest organization in the world giving attention to plant problems. The Arlington Farm which he has developed as a *field laboratory* for the United States Department of Agriculture is often commented upon as a model for similar laboratories for governmental and educational institutions. The key to the success of this enterprise rests in the fact that the man charged with the immediate control of the farm conducts no personal investigations, his only project being the maintenance of the farm. That implies putting it into the best possible condition to meet the needs of 30 or more investigators who are carrying on research work at the place. A special appropriation is provided for the maintenance of the Farm but each investigator meets the actual cost of his field work. This enterprise was undertaken in 1901 and has steadily grown from that day to this.

A little later the demand for information regarding the methods and practices of successful market gardeners and truck farmers led to the formation of an office in the Bureau of Plant Industry of the Department of Agriculture for meeting the problems of the vegetable gardeners who at the time were unorganized and without even so much as a popular organ to represent their great industry. For ten years information regarding the industry has been accumulated and the work is still going on with no cessation of interest, although it has recently been combined with pomology under a single administrative office. The new office is known as the Office of Horticultural and Pomological Investigations which was under Professor Corbett's direction until he was drafted into his present duties.

A little later Professor Corbett is to announce two books. One he has spent many years in preparing. It is being published by the Ginn Company of Boston and will be entitled "Garden Farming." The other was prepared for the Outing people of New York and will be called "Intensive Farming."

'74, B. S. in Agr.—William R. Lazenby has been the head of the Department of Horticulture and Forestry in Ohio State University for the last 32 years. He attended the meeting of the Cornellian Council and Cornell Alumni Association and also the exercises at the last June commencement. He was the guest of his classmate, Professor J. H. Comstock while in Ithaca.

'91, B. S. in Agr.—Clarence W. Mathews has been, since January 1892, Professor in Kentucky State College, now Kentucky State University. He was formerly Professor of Horticulture and Botany, now of Horticulture and Horticulturist of the Kentucky Agricultural Experiment Station.

'98, B. S. in Agr.—Mr. E. L. Andrews who has been registered as a graduate student, specializing in

Poultry Husbandry, has accepted a position as Assistant Professor in Poultry Husbandry in the West Virginia Agricultural College, Morgantown, W. Va.

'06, B. S. A.—W. G. Brierly received the degree of M. S. in Hort. at the Washington State College and has taken a position as Assistant Professor of Horticulture at the University of Minnesota.

'06,—F. S. Jacoby and Miss Ruth McManamy were married on June first.

'06, W. C.—A. C. Herrick and Miss Loraine Heyer were married on June 4th and are living at Ossining, N. Y.

'06, Sp.—R. H. Dayton is manager of a farm of 350 acres owned by Paul T. Brady and situated between Patterson and Pauling, N. Y.

'07, B. S. A.—C. B. Tilson has accepted a position in Farm Bureau Work in Clinton County. His headquarters are at the Chamber of Commerce, Plattsburg, N. Y.

'07, B. S. A.—Professor H. C. Pierce is in charge of the field laboratory of the Bureau of Chemistry, United States Department of Agriculture, Washington, D. C., located at Sedalia, Mo., where, with a corps of specialists, he is investigating the market conditions and transportation of dressed poultry.

'07, B. S. A.—J. B. Shepard has resigned his position as Secretary-Treasurer of the San Marcos Utilities Company and has taken a position as Agricultural Engineer with the J. G. White Companies, 43 Exchange Place, New York.

'08, B.S.A.—The address of Edwin Earle, jr., is changed to Carters Bridge P. O., Virginia.

'08, B. S. A.—Andrew William McKay was married to Miss Margaret Curtis (A.B., '09), daughter of Mr. and Mrs. Gram Curtis, at Newcastle, Pa., on July 23. McKay is in the Bureau of Pomology of the U. S. Department of Agriculture and will be located in Portland, Oregon, for a least a year to come.

'08, B. S. in Agr.—T. H. Desmond has opened offices at Hartford, Conn. for the general practice of landscape design.

'06, '08, Sp.—O. F. Ross is manager of the Franklin County Farm Bureau with headquarters at Malone, N. Y.

'09, B. S. A.—Dr. and Mrs. Lewis L. Rogers of Kingston, Penn., announce the engagement of their daughter Mary Cushing to Sherman P. Hollister.

'10, W. C.—George H. Sprague has severed his connection with the Lyndon School of Agriculture at Lyndon Center, Vt., and is Farm Superintendent at the Turner Hill Farm, Ipswich, Mass.

'11, B. S. A.—Mr. L. H. Schwartz, is in charge of the poultry department of the Milwaukee County School of Agriculture and Domestic Economy at Wauwatosa, Wis.

'12, B. S. A.—G. M. Butler has been appointed Farm Bureau Agent in Allegany County.

'11, B. S. A.—Jackson Demary is agricultural county agent for Orange County, Vermont, since July 9.

'11, B. S. A.—Mr. J. E. Dougherty is in charge of the Poultry Department of the State Agricultural College at Davis, Cal.

'12, B. S. A.—Mr. Harry Embleton is instructor in Poultry Husbandry at Purdue University, Lafayette, Ind., where Professor A. G. Phillips, W.P.C. '08, is in charge of the Poultry Department.

'12, B. S.—Gustavus Edward Bentley was married to Miss Lesbia Harriet Andrews (Special, '12), daughter of Mr. and Mrs. Earle Deloss Andrews, at Busti, N. Y., on July 26. Their home will be at Fluvanna, N. Y.

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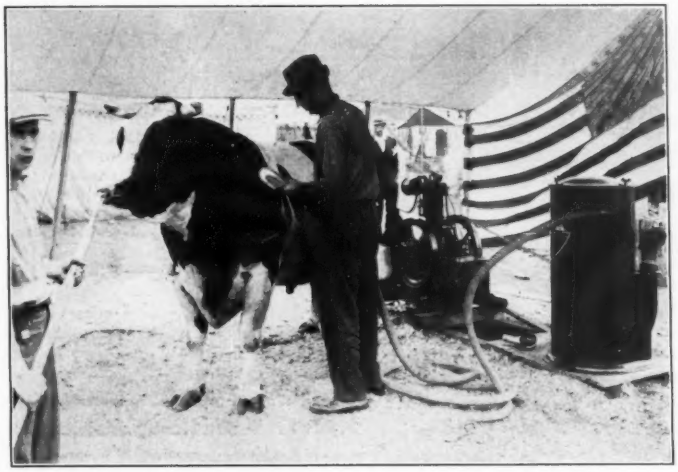

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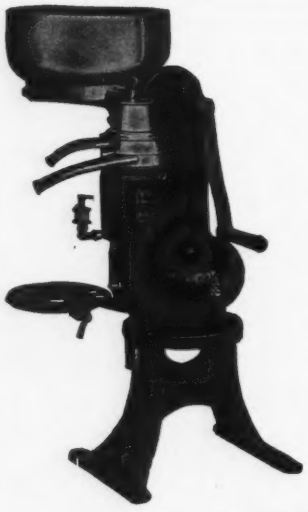

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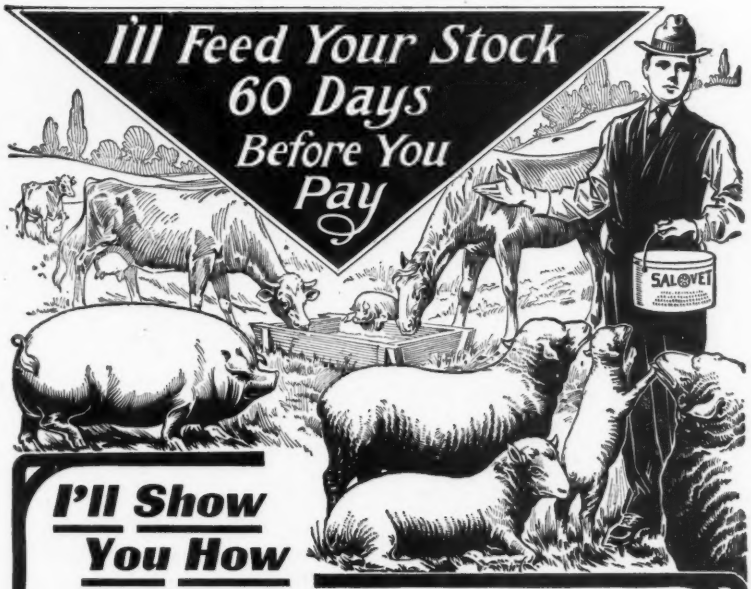

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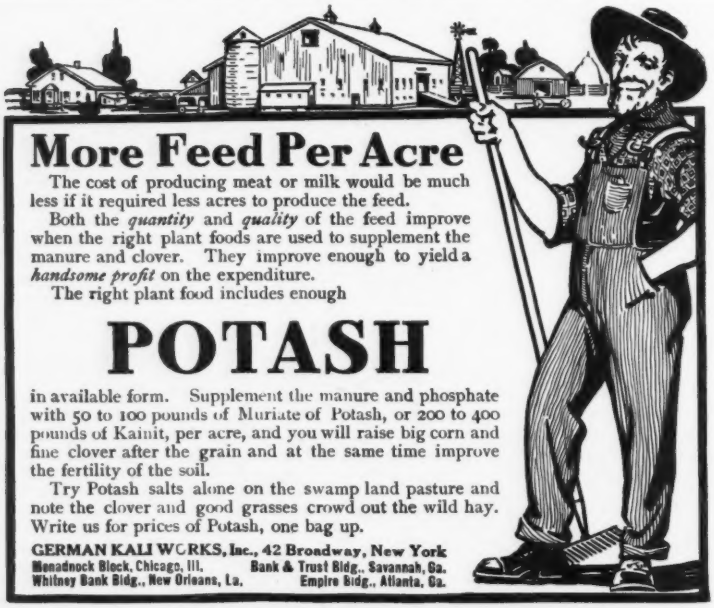

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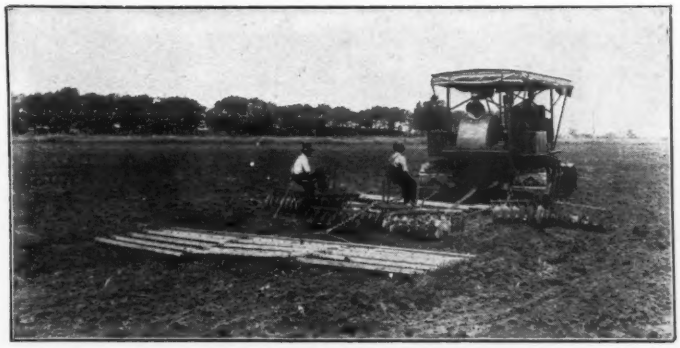

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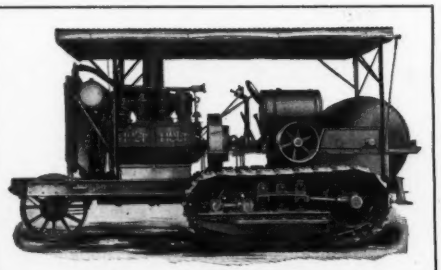

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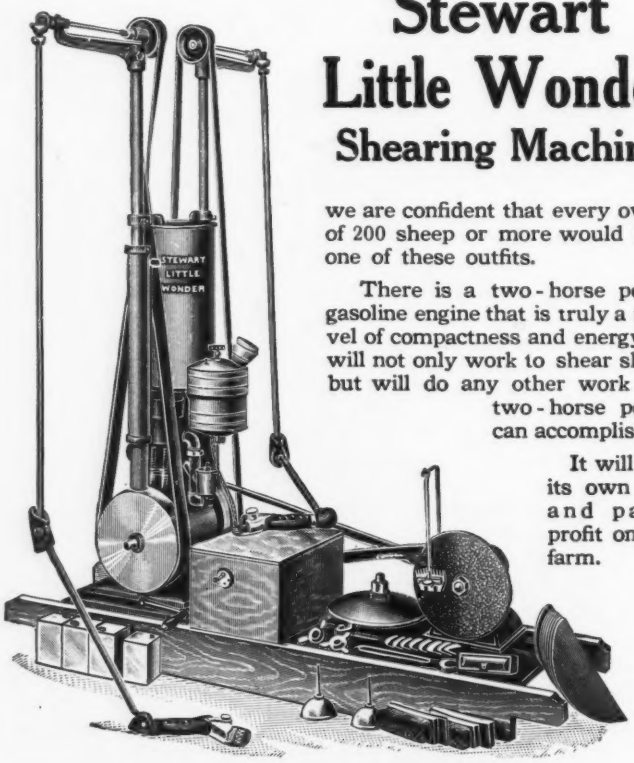

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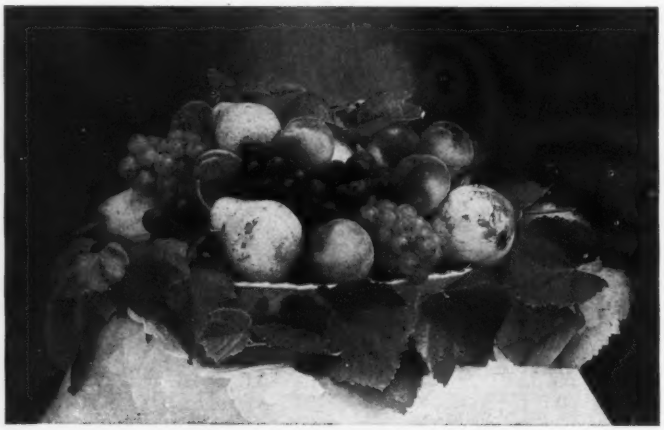
Halftones *Illustrations*
Line Etchings *Designing*
and
Embossing Plates



We are Specialists in

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If you want to increase the selling power of your next catalogue, if you want to make your advertising as effective as possible, you should look into the question of using color reproductions. Our success lies, not alone in the making of proper plates, but in printing them as they should be. Our product is used by companies of international reputation. We shall be pleased to submit estimates or samples of work.

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SAMUEL FRASER

Geneseo, N. Y.

Consulting Agriculturist, Fruitgrower and Nurseryman

We have 250 acres of orchards under our direct management and propagate nursery stock from selected bearing trees of merit.

500,000 first class fruit trees from which to select.

No scale. *True to name.*
Healthy, vigorous trees. *Catalog free.*

AIR—TIGHT
FROST—PROOF
PERMANENT

No hoops to tighten or loosen.

Don't order your Silo before you get our free catalog.

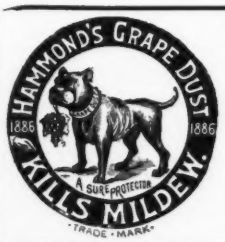
CRAINE Patent Triple Wall **SILO**

3 Walls

—therefore 3 times as warm and 3 times as strong.

Let us tell you more.

THE W. L. SCOTT LUMBER CO.
Norwich, N. Y.
Milwaukee, Wis.



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Used effectively to kill Mildews on Roses and other Plants . . .

Sold by the Seed Dealers.
For pamphlet on Bugs and Blights address

HAMMOND'S PAINT & SLUG SHOT WORKS
BEACON, N. Y. (Fishkill-on-Hudson, N. Y.)

"SCALECIDE"

TRADE MARK REG. U. S. PAT. OFFICE

DON'T NEGLECT FALL SPRAYING. GET READY NOW.

Many trees can be saved that would die before Spring if unsprayed. "SCALECIDE" will *positively destroy San Jose* and *Cottony Maple Scale, Pear Psylla*, etc., *without injury to the trees.*

Many of the finest orchards in the country have been sprayed with "SCALECIDE" for the past eight years, producing record crops and prize winning fruit. It **costs less** to spray with "SCALECIDE" than Lime-Sulfur, and **does better work.** We stake our reputation on this assertion. Write today for our booklet, "Scalecide, the Tree Saver." Sent free on request.

Our **Service Department** furnishes everything for the orchard at money-saving prices. **Tell us your needs.** B. G. PRATT CO., 50 Church St., New York City.

Dixie Brand

COTTON SEED MEAL

THE CHEAPEST SOURCE OF PROTEIN FOR DAIRY COWS

HUMPHREYS-GODWIN CO., Memphis, Tenn.

72 Feet Wide, Iron Frame Lettuce House

Erected for J. H. West & Sons, Irondequoit, N. Y.

THEY started with our 30 feet Pipe Frame houses and after building five, jumped to one 72 feet wide, of Iron Frame construction.

Mr. West says he is convinced that wide houses are cheaper per square foot than small ones.

With houses from 30 feet up he claims that "the proportionate expense decreases rapidly." And he's right!

Erection costs are considerably less.

Mr. West made the rather amazing statement that "not a single bolt hole was drilled untrue" in the materials of his new house; everything actually went together like clock work, just as we said it would.

He also claims that these wide houses are both lighter and airy. They overcome that heaviness and stuffiness found in small houses, which most certainly retards a free natural growth.

Tomatoes and cucumbers being very sensitive to sudden chills, the fact that the air is warmed before it reached the plants is a particularly valuable feature.

But to be both practical and highly productive, wide houses must be constructed with the greatest care.

The wind strain on them is terrific.

We took more orders for wide houses the past year than in any two previous years combined.

Before you put a dollar into another house let us go over the construction question with you from A to Z. We will send one of our representatives tomorrow if you say so.

Be sure to send for our catalogue anyway.

Lord & Burnham Co.

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A postal card request will bring you a copy of our list of some hundreds of

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compiled from our lists of regular and recommended books as used at the N. Y. State Agricultural College here at Cornell : : : : : : : : :

✦ ✦

The Corner Bookstores

ITHACA, N. Y.

EXPERTS

If you should speak to butter experts about dairy cleanliness or sanitation they would immediately think of—

Wyandotte
Dairyman's
Cleaner and Cleanser

With them the two are synonymous. They know the requirements of the one are most thoroughly and safely met by the properties of the other.

Buttermakers know they cannot work with "certainty" if their utensils are cleaned with a soapy cleaner as milk is an excellent detector of soapy odors. The slightest trace of soapy grease on milk utensils is absorbed, and consequently the milk quality is destroyed and the butter quality lessened.

Indian in Circle

in every package

Neither is the buttermaker certain of the results unless he is positively sure all utensils are sanitary. "Wyandotte" has proved to him time and time again that it does clean sanitarily. Its purity and its sanitary cleaning, these two factors have made Wyandotte Dairyman's Cleaner and Cleanser the one first choice of thousands of buttermakers and of dairy college authorities who teach the scientific principles of buttermaking.

Ask your dealer for a sack or write your supply house for a keg or barrel.

THE J. B. FORD CO., Sole Manufacturers
Wyandotte, Mich., U. S. A.

This Cleaner has been awarded the highest prize wherever exhibited.

It's very human for one to buy his shoes from the store that can offer the most inducements in the way of style, assortment, quality and big value. For that reason we expect to see you in this store very soon now.

THE NEW

Fall Styles

are priced at **$4.00 to $5.00**

Banister make $6.00 to $10.00

ITHACA BOOT SHOP, Inc.

204 E. State Street

New York Life Insurance Company

C. H. WEBSTER, Agent

OFFICE: Student Supply Store
RESIDENCE: 121 Catherine St.

BOTH PHONES

WE have been led to believe that through the medium of "The Cornell Countryman" an appeal would reach the most progressive and successful fruit growers in New York State. We are one of the many soliciting patronage from readers of this publication, but our success has been made possible by catering to the demands of orchardists who seek quality first—then ask the price, and we think through this advertisement we will find prospective users of spray material that are of this kind. Fortunately we have the distinction of being called the "high-priced people," which we accept as a supreme compliment, for we submit the proposition to you and ask if it would be at all possible for us to secure re-orders for our product every year for the past four years from users of spray material, and, in addition very largely increase our output each season, if we had nothing to recommend us but a high price. We are not a peculiar people, but offer Lime and Sulphur Solution of a distinctive, peculiar kind—a particular product for particular people. Ask us something about it and mention "The Cornell Countryman."

The Rex Company

ROCHESTER, N. Y.

P. O. BOX 712

LOCK SPEED

Lock speed is a big element of success in making high scores at the trap or in the field.
When you pull the trigger you want it to go with lightning speed.
Flying birds and targets will not wait for a hang fire load or a slow lock.
Our lock was carefully and scientifically timed at the University of Cornell.
Test was made by means of a fly wheel traveling 577.1715 inches per second. By means of a special device it was found that the fly wheel traveled .935 inches while hammer was falling. Dividing .935 by 577.1715 gives the time it took the hammer to fall .0016+ or expressed in fractional form $\frac{1}{625}$ of a second.
When hammer struck it was traveling 233 inches per second.
We figure that this greased lightning speed will increase your score at least 5 per cent.
The slower the lock and the slower the load the farther you have to lead your birds.
Brand new catalogue FREE—describes 18 grades guns—$17.75 net to $400.00 list.
New edition to the Ithaca family is a little 28 bore, weight 4¾ to 5¼ pounds.
Our little 5¼ pound 20 bore is a howling success.

Ithaca Guns

ADDRESS—ITHACA GUN COMPANY

ITHACA—NEW YORK

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WE BIND ANYTHING

J. WILL TREE'S

113 N. Tioga Street

WISNER STEEL HAND CART

Platform hangs low; rides level. Will hold four 40-qt. milk cans. Tips forward like warehouse truck. Will turn clear over to dump load. Fitted with large body for farmers.

. . . Write for Prices . . .

WISNER MFG. CO.,
230 Greenwich St., New York

Established 1887

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RETAILING, WHOLESALING AND JOBBING GROCERS

JOHN J. LARKIN, Proprietor and Manager

408 Eddy Street, Ithaca, N. Y.

An Innovation

that has proven very popular among the boys—namely this—any clothing purchased here will be cleaned, pressed and repaired *free of charge for one year.*

MINTZ'S

129--East State Street--131

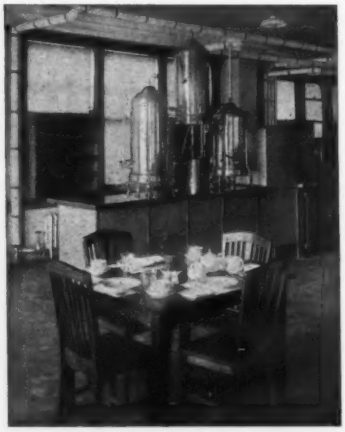
The L. J. Carpenter Tailor Shop

Sanitary Steam Pressing : :

205 North Aurora Street

Cleaning, Pressing, Dyeing, Repairing, Etc.

Bell 'Phone 567 Ithaca 'Phone 420-x



Cafeteria

HOME ECONOMICS BUILDING

THREE MEALS DAILY

MAK-GRO Odorless PLANT FOOD *for* FLORISTS *and* GENERAL GREENHOUSE WORK

A Scientific, Improved, Concentrated, Quick-Acting, Complete Fertilizer, made in Non-Acid Granular Form from the Highest Grade Materials obtainable.

Especially adapted to Greenhouse Work for Flowers, Fruits and Vegetables.

Special Formulas for General and Special Greenhouse Crops, prepared by men who have made a life study of Greenhouse Work—not only in this country but abroad.

The services and advice of our experts is at your disposal on all matters pertaining to your Greenhouse problems.

MAK-GRO ODORLESS PLANT FOOD is put up in various sized packages, and is sold in lots of from one pound to a carload.

The one-pound cans and small packages make a splendid side line for Florists having their own stores.

Write us for further particulars.

CONSUMERS FERTILIZER CO., **Longacre Building Suite E, New York**

Investigate the advantages of the Kinderhook Country

Do not wait until our large fruit plantings come into bearing. Come and help develop the most promising community in the Hudson River Valley.

Land from $75 to $100 per acre

Send for booklet to

Rural Life Co.

Kinderhook, N. Y.

GOULDS RELIABLE SPRAYERS

SPRAYING is effective only when well done. Goulds Sprayers are famous all over the world—even at slightly higher price—because they are best designed and built for effective spraying, and made proof against the corrosion of spray solutions.

Write for Our Book

"How to Spray—When to Spray—What Sprayer to Use"

Full of valuable spray formulas and interesting information.

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Ithaca's Leading Hotel

American and European Plan

All rooms have running hot and cold water, electric lights, local and long distance telephones. Our feature is the modified European plan, served in the Dutch Kitchen at the most reasonable prices obtainable.

RATES

American Plan, $3.00 and up.
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J. A. and J. N. CAUSER, Props.

STUDENT SUPPLY STORE

The Modern Method Laundry

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Heggies' Jewelry Store ===

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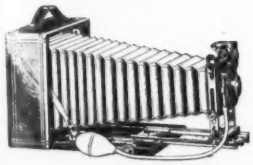
ART plays an important part in its influence upon the human mind.
The **HOME MADE BEAUTIFUL** is the function of

THE H. C. CABLE ART STORE

To you we extend a **welcome** at 405 College avenue



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Neatly and Promptly Done

Shoes called for and delivered in any part of the City

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New and Rebuilt
Any Make
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Special Rates for the College Year

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LIVERY ITHACA, N. Y.

PIANOS, MANDOLINS, GUITARS, BANJOS and VIOLINS

Rented or sold on Easy Payments. **"Songs of Cornell."** All the latest music; Strings and supplies for all instruments at lowest prices.

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Victor Talking Machines, Records, Etc.

Established 1887

LARKIN BROS.

Retailing, Wholesaling and Jobbing Grocers

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Has been our Success

New Process Dry-Cleaning did it

Because it Cleans Clean

Modern Dry Cleaning and Pressing Works

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Engraved Cards and Invitations **Rubber and Metal Hand Printing Stamps**

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Photographer for the Senior Class

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The oldest and largest
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—— a Specialty ——

New York State College of Agriculture at Cornell University

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Breeds Percheron Horses, Holstein, Jersey, Guernsey, Ayrshire, Short Horn Cattle. Dorset, Shropshire, Rambouillet Sheep. Cheshire Swine. Regular Public Sale of all Surplus Young Stock, except Swine, on

FRIDAY OF FARMERS' WEEK EACH YEAR

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"If you get it from us it's right"

BUTTRICK & FRAWLEY

One Price Clothiers and Furnishers

This fall season finds us more fully equipped to satisfy your wants than ever before. Special attention has been paid to get best material at minimum price. **Suits and Overcoats, $10.00 to $30.00; Raincoats, $5.00 to $30.00; Mackinaws, $6.00 to $12.00.** We make Suits to measure and save you from $5.00 to $10.00.

VISIT OUR SHOE DEPARTMENT

Hats, Gloves, Shirts, Sweaters, Underwear, and all other articles you'd find in a first class shop. **Full Dress and Tuxedo Suits for sale and to rent.**

"If not we make it right" **134 East State Street**

PROFESSORS, STUDENTS, INSTRUCTORS, you will get **MORE INSURANCE for LESS MONEY** if you have a policy with

The Travelers Life Insurance Company

OF HARTFORD, CONN.

J. J. SINSABAUGH, Agent

149 East State Street **ITHACA, N. Y.**

INSURANCE OF ALL KINDS **Ithaca 'Phone**

Williams Brothers

ITHACA, NEW YORK

WELL DRILLING MACHINERY AND TOOLS

Shoes For All

Yes, we have shoes for all and to suit all pocket-books Prices ranging from $4.00 to $8.00. : : Quality, workmanship and fit guaranteed. We invite your inspection. :

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OPPOSITE TOMPKINS COUNTY BANK
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CARR & STODDARD
MERCHANT TAILORS
UP-TO-DATE STYLES AND WORK
SENECA AND AURORA, NEXT LENT'S MUSIC STORE

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Clothing and Furnishings

have pleased hundreds of **CORNELL** students during the last **Five Years.** Why? Because we sell only first class merchandise and guarantee every dollar's worth of it; we fit our clothing to please; **our service** is unexcelled, and last but not least, we sell at **One Price to All.**

Please consides this "Shop," "Your Shop." You get your money's worth here.

E. B. BAXTER,
ONE PRICE TO ALL
"The Quality Shop"
Satisfaction guaranteed
150 E. State St., Ithaca, N.Y.

Gentlemen—

You are cordially invited to inspect our excellent variety of **WOOLENS** in both Foreign and Domestic and they are exclusive in Styles for Suits and Overcoats, also are approved for all occasions for Fall and Winter.

Urband & Son
Tailors
Opposite City Hall

D. S. O'BRIEN
MARKETS
222 North Aurora Street **430 North Cayuga Street**
DEALER IN
FRESH, SALT AND SMOKED MEATS
Poultry and Game in Season
D. S. O'BRIEN

Pennants
Banners
Pillow Tops

18″ x 36″ at $ .98
24″ x 48″ at $1.75
36″ x 72″ at $2.97

In Leather, Felt and Satin

Why not take a look at our College Color Exhibit? The quality is classy and terms most reasonable. You will save money and get what you seek by calling on us.

Room Furnishings

The decoration of students' rooms has been our specialty for years. Allow us to make some helpful suggestions in your selection if undecided. It costs nothing and we like to do it.

One Call Will Make Your Confidence Absolute in

12″ x 30″ at 50c
15″ x 36″ at 75c
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Rothschild Bros.

The Shops of Shops

Come right in to headquarters where you can find everything for man's wear at lowest prices.

Leave your measure for ONE HALF DOZEN SHIRTS for ONE DOZEN DOLLARS.

We have a whale of a stock of Furnishing Goods, Hats and Caps.

TOWN SHOP, 142 E. State St. — **L. C. BEMENT** The Toggery Shops — **HILL SHOP,** 413 College Ave.

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135-137 E. State St. — **ESTABLISHED 1836**

Capital $100,000 — **Surplus and Undivided Profits $165,000**

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Cornell Library Building

Capital, Surplus and Profits, $350,000.00

Oldest National Bank — Safe Deposit Boxes for Rent

ITHACA SAVINGS BANK

INCORPORATED 1868

Tioga Street, cor. Seneca — ITHACA, N. Y.

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QUALITY, SERVICE AND CLEANLINESS

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Manufacturers of Special Furniture for

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(Opposite Tompkins County Bank)

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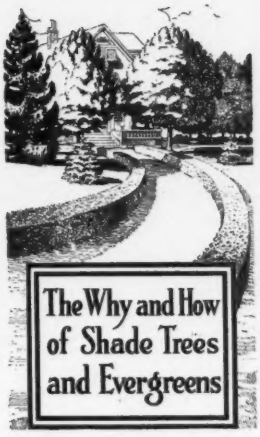
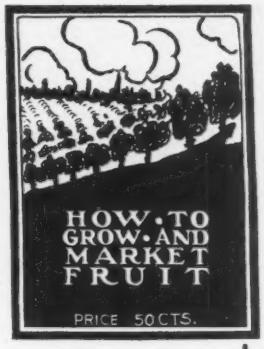




Every Orchardist and Student Should Have These Three Harrison Books

Out of the wealth of our experience with more than three hundred thousand fruit trees that are bearing, and more than twenty-five hundred acres of land in young fruit trees, we publish *three books*.

OUR COMPLETE NEW CATALOG FOR 1914. One of the new kind of catalogs that tells the truth about the goods they describe, and which gives the facts that every buyer needs. Contains a wealth of condensed information. Describes faithfully all leading varieties of fruits and ornamentals. This book is free.

HOW TO GROW AND MARKET FRUIT. A complete guide book for fruit growers, written especially to inform orchardists of up-to-date practices. Tells *why* each operation should be done. Shows how to handle an orchard properly in 1914. Endorsed by many experiment stations and used as a text book in colleges. 150 pages. 90 pictures, flexible covers. Price 50 cents and that amount rebated with your first $5 order for our products.

THE WHY AND HOW OF SHADE TREES AND EVERGREENS. A guide book for those who plant home grounds. Analyzes the planting problem, classifies all trees, vines, etc., according to their uses and purposes, and makes clear what to select and how to plant it. This book is free.

"GET" THESE POINTS AND SALT THEM DOWN

We Bud our Fruit Trees from Bearing Orchards. We don't propose that planters of Harrison trees shall have drone orchards or drone trees. The parents of Harrison-grown trees are selected for superior bearing habits. Harrison trees are true to name, and they regularly produce heavy, flawless crops.

Only Trees we Grow are Sold by Us. In no other way can we be sure that the trees we sell are true to name and have bearing habits and abilities to meet our customers' needs. Remember, we grow all the trees we sell!

Come to Berlin. You can see for yourself the truth of all our claims for superiority of product if you will come to Berlin for a visit. Come from Philadelphia or Baltimore. No education is complete without personal knowledge of the fertile, famous EASTERN SHORE. You pass through the length of it when coming to Berlin. The Atlantic Ocean is only seven miles from here. Come, and we will pay your hotel bill while in our town.

Place Orders Early for 1914 Planting. There are many sound reasons why you get better trees and better service in their delivery when your specifications and reservations reach us *early*. We will explain them to you if you ask. Write today for catalog, and get the other books. Tell us what you are interested in if possible.

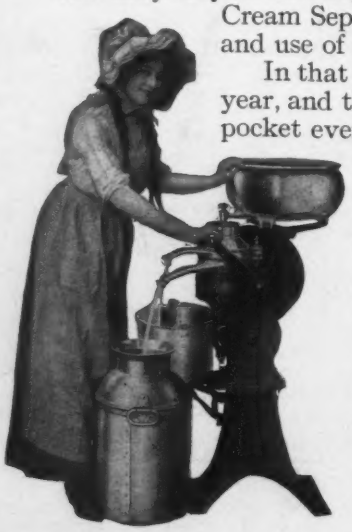
HARRISON'S NURSERIES, Cornell Street, BERLIN, MARYLAND

"SAVING THE COST"
OF A
DE LAVAL
CREAM SEPARATOR

Almost invariably the man who goes without a separator or buys an inferior one does so to "save the cost" of a De Laval.

No reasoning could possibly be more deceptive. No greater mistake could possibly be made.

The only way to actually save the cost of a De Laval Cream Separator is through the purchase and use of one.



In that way you save the cost the first year, and the same saving goes into your pocket every year afterward for twenty years or more.

Without a separator you don't "save" anything—you waste the cost of a De Laval every year in quantity and quality of product and have nothing to show for it.

And so too with a poor separator, you waste the slight first cost saving over a De Laval half a dozen times over every year and still have only the poor machine in the end.

You "pay" for a DeLaval separator every year whether you want to or not. With a De Laval it goes into your pocket every year after the first one. Without a De Laval the same amount goes to waste every year and benefits no one.

Will you pay for your De Laval and have it or go on paying for it every year and not have it?

A new De Laval catalog to be had for the asking may help you to decide.

THE DE LAVAL SEPARATOR CO.

NEW YORK CHICAGO SAN FRANCISCO SEATTLE

PRESS OF W. F. HUMPHREY, GENEVA N. Y.